

Contribution of Human Factors to Shipping Safety

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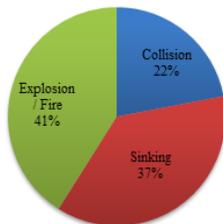
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Graphical abstract



Abstract

This paper empirically determines “Contribution of Human Factors to Shipping Safety”. Human factors can be classified into three categories. They are organizational factor, group factor, and individual factor. Based on its classification, a questionnaire was made. A questionnaire was tested to 30 respondents who are working at a shipping company (PT. Baruna Jaya) to determine its validity and reliability by using Ms.Excel program. After the test is done, results show that 17 organizational factor statements, 11 group factor statements, 12 individual factor statements, and 10 shipping safety statements are valid with a reliability value for each variables are 0.860, 0.767, 0.721, and 0.8. By using its valid statements, questionnaires distributed to 86 respondents who are working as passenger ship’s crew at two shipping companies (PT Baruna Jaya and PT. Lestari IndomaBahari). After obtaining data, analysis requirements test (normality, homogeneity, linearity and independence test between independent variables) needs to be done to determine the statistical method to be used. Correlation and regression method by using SPSS program was used to determine the contribution of human factors to shipping safety, either carried out independently between an independent variable to dependent variable, or together between three independent variables to the dependent variable. Analyzed data was found that there are 28.8% contribution of human factors to shipping safety with correlation coefficient is 0.488. This lower contribution of human factors to the shipping safety is one of the causes of ship accidents frequently happen in the case study area. During the last two years there were 22 cases of ship accidents. With respect to that all parties which involve in shipping include shipping companies, the ship’s owners, government, regulatory authorities, classification society and other parties should take a serious concern about safety in shipping by improving on all aspects of human factors.

Keywords: Human factors; shipping safety; correlation and regression method

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1.0 INTRODUCTION

The human factors found can affect safety.^{17,14,42,15,18,9,6,7,31,23,32,10,28,13} It can be classified as 3 categories. They are organizational, group and individual factors. At the organizational category, various factors may contribute the incidents and accidents, including company policies, company standard, and system and procedures. In the group category, management, supervision and work with relationships between members of a work group have the potential factor to influence the safety. And at the individual category, competence of the individual, perceptual judgments, stress, motivation, health risks (such as work over-load) and the contribution of human error can make a probability of accidents happen.⁴³ However, the most significant problem which influence shipping safety that can cause accident, like collision or contact (can be ship to ship or ship to other structure), capsizing, sinking, breaking up, grounding, breakdown of the ship underway, stranding, and fire or explosion are mostly caused by human.¹⁷ Hence, this study is to be undertaken to discuss shipping accident in case study area, to determine

indicators of human factors that influence shipping safety, to determine how much correlation and contribution between human factors and shipping safety.

2.0 LITERATURE REVIEW

2.1 Human Factors

The term used for human factors and human error always exchange in many industries without clearly defined. The terms are usually used for referring the cause of the accident that related to human. Human factors are scientific study of interaction between human and machine.¹⁴ Then its definition has expanded up to cover individual, group, and organization as a factor that might affect safety.⁴³ While Smallegange, *et al.* states that the Human Factors in Accidents at Sea as those accidents involving ships and their crew and cargo, which accidents are in some way linked to a human as opposed to a purely technical failure.³⁵

There are three categories influencing human factors.⁴³ They are individual factors, group factor, and organizational factors. Individual factor which includes competence level, stress, and motivation. Group Factors include: management weaknesses, supervision and crew factors. And organizational factors which include company policies, company standards, systems and procedures. A study by the Institute of Nuclear Power Operations showed that the underlying cause of at least 92% accidents in the nuclear industry is caused by human. It covered organizational, group and individual factors.²¹

2.2 Shipping Safety

According to Indonesia Marine Safety Coordination Agency, shipping safety is a condition that complies with several requirements regarding safety and security of transportation in water, port, and maritime environment.²⁰ Shipping safety basically is all activities that exist and can be developed in relation to accident prevention activities in the shipping area. In Indonesia several requirements regarding to safety and security of transportation in water, port, and maritime environment regulated in Indonesia Law No.17 of 2008. Based on its Law, these requirements are:

- I. Overall physical conditions of ship. They are construction, stability, electrical, and machinery while sailing.
- II. Ships must be equipped with a certificate and compliance document of ships while sailing.
- III. Ships must be equipped with navigation equipment and/ or ship's electronic navigation that comply with requirements according to the type, size, and its shipping area.
- iv. Ships must be equipped with radio communication device and its accessories that comply with requirements according to the type, size, and its shipping area.
- v. Ships are fitted with metrology equipment that comply with requirements according to the type, size, and its shipping area.
- VI. There are good information systems between ships and shipping information providers about the weather and sea conditions and its forecast.
- vii. The ship is equipped with enough safety equipment (Life jackets, lifeboats, life raft, lifebuoy) according to the number of passengers and crew while it ship is sailing.
- viii. Ships are equipped with adequate fire fighting equipment while it ship is sailing.
- ix. Ships are equipped with an alarm signal that have well functioning when it ship is sailing.
- x. Navigational equipment can help to improve safety and efficiency of navigation while it ship is sailing.
- Xi. Operation of telecommunications systems can help to improve shipping safety while it ship is sailing.
- xii. Repair and maintenance are done periodically as an effort to increase of shipping safety.
- xiii. Monitoring and checking to shipping safety requirements that be done by the competent authority is conducted as an effort to increase shipping safety.

Shipping safety have been also regulated by international agencies that managing and handling all matters related to the safety of life, sea properties, and sustainability of the marine environment. Its agency is called International Maritime Organization (IMO), which under the United Nations. One important factor in achieving the safety and sustainability of the marine environment is the human factors. It human factors related to managing, supervising, competence level, stress, and motivation of people. Because somehow solidness of construction of a ship and no matter how sophisticated the technology and good navigational equipment, without good human factor according to their function then it will be vain.

2.3 Shipping Accidents

Shipping accident is Shipping accident is a term generally used for any accident results in financial loss, either in life and/or property or both.¹ The reasons for shipping accidents are many and complex. Increased sizes of ships to achieve economies in transportation costs are one of the primary reasons. Bigger size brings corresponding increases in cargo and passenger capacity; hence when an accident or a casualty occurs, the risk of life and property immediately becomes higher. Reduced shipping maneuverability in connection with larger scale, which ultimately is a function of increased risk, is another contributing factor in marine accidents.⁸

There are many types of shipping accidents and can effect to the environment around the ship, its property from the ship, and can effect to the people. Collision or contact (can be ship to ship or ship to other structures), capsizing, sinking, breaking up, breakdown of the ship underway, stranding, and fire or explosion are examples of shipping accidents commonly.²

Based on investigation of the national transportation safety committee of Indonesia, there are 28 cases of ship accident was investigated from 2007 to 2011 with several types of ship accident (Figure 1).²⁹

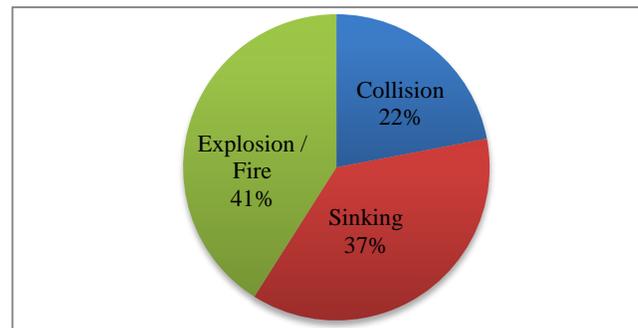


Figure 1 Percentage type of ship accident (National Transportation Safety Committee of Indonesia, 2011)

From time to time ships have the greater size. In economic scale it makes a benefit due to the more capacity for carrying goods and passengers. So when the accident happens, the risk is high. The possibility of losing property and life is enormous.

There are many factors that make accident happen. Generally can be classified as several factors.²

- i. Natural conditions could be natural phenomena such as tidal stream, high wave, strong winds, restricted visibility due to fog, smoke, rain or snow, storm, etc.
- ii. Technical failure such as lack of repair and maintenance, steering failure, engine failure, and structure failure as a result from lack of accurately ship design.
- iii. Human factors are all of human factor which contribute accident happen both of organization, group, or individual factor.

According to Marine Safety Authority of New Zealand^{49%} of shipping incidents cited human factors as a cause, while only 35% cite technical factors and 16% environmental.²⁴ The most common human factors causes were errors of judgment and improper lookout or watch keeping, followed by failure to comply with regulations. The 'human element' as it is often termed in the shipping has frequently been cited as a cause of these costly incidents.

4.2.2 Homogeneity Test

Beside test of normality data, test of homogeneity data also needs to be done. It is intended to view data that be obtained from a homogeneous sample. Homogeneity test is very important if researchers will be generalizing the result of their study. A hypothesis that is proposed for this homogeneity test are as bellow:

H0 = Data distribution is not from homogeneous sample

H1 = Data distribution is from homogeneous sample

By using a basis of decision making if value of Asymp. Significance more than the value of significance level (0.05), H1 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H1 is rejected. The result of normality test are value of Asymp. Sign for each independent variable to dependent variable are 0.136, 0.097, and 0.131. While the value of significance level that be used is 0.05. Based on the basis of its decision making above, H1 is accepted. This can be stated that distribution data is from homogenous sample.

4.2.3 Linearity Test

Linearity test is a test that be done to view data distribution of each independent variable is from a linear line to the dependent variable. The hypothesis that be proposed for this linearity test are as bellow:

H0 = Data distribution of Independent variable is not form a linear line to the dependent variable

H1 = Data distribution of Independent variable is formed a linear line to the dependent variable

By using a basis of decision making if value of Asymp. Significance more than the value of significance level (0.05), H1 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H1 is rejected. The result of linearity test are value of Asymp. Sig (Deviation from linearity) for each independent variable to dependent variable are 0.413, 0.535, and 0.421. While the value of significance level that be used is 0.05. Based on the basis of its decision making above, H1 is accepted. This can be stated that Data distribution of Independent variable is from a linear line to the dependent variable.

4.2.4 Independence Test between Independent Variables

Independence test between independent variables is done to know there are any correlations between its three independent variables. If there is a large and significant correlation between its three independent variables, its mean its three independent variables are not independent. The result Independence test between independent variables are correlation between variable X1 and X2 is 0.041 and significance value is 0.79. The correlation between variable X1 and X3 is 0.126 and significance value is 0.247 and the correlation between variable X2 and X3 is 0.125 and significance value is 0.093. All of significance value is more than the value of significance level. Although it means there are correlation between three independent variables but it is not significant.

4.3 Hypothesis Test

Hypothesis test is conducted by using the correlation method and linear regression analysis, either linear regression with one independent variable nor linear regression with some independent variables. These correlation method is used to know how far correlation between independent variables and a dependent variable. At the same time linear regression analysis is used to

determine the contribution of independent variables to the dependent variable in a linear equation.⁴⁰

There are two principal tests in linear regression analysis. The first one is linearity test and the second one is coefficient test. Linear regression analysis with some independent variable usually also requires autocorrelation test. The autocorrelation test indicates whether random or not a data. Autocorrelation is a coefficient that indicates a correlation between two values of the same variable on time horizon x_i and x_{i+k} . Autocorrelation can be conducted by using a Durbin Watson test. If the value of Durbin Watson less than 1.21 or more than 2.79, its mean there is autocorrelation.

4.3.1 First Hypothesis

First hypothesis are shipping safety is contributed by organizational factors. The hypothesis that be proposed for this first hypothesis test are as bellow.

- H0 = Shipping safety is not contributed by organizational factors

- H1 = Shipping safety is contributed by organizational factors

By using a basis of decision making if value of Asymp. Significantly more than the value of significance level (0.05), H0 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H0 is rejected. The result of the first hypothesis test is the correlation coefficient between organizational factor and shipping safety (r_{x1y}) is 0.368 and its determination coefficient is 0.135 with significant value is 0.000. (Less than significance alpha 0.05). it is indicated that the correlation between organizational factor variable (X1) and shipping safety (Y) correlate at confidence level 95%.

Linear regression analysis with one variable independent is conducted to know the correlation between organizational factor variable (X1) and shipping safety (Y) predictive or not.

Based on calculation then obtain regression line equation is $Y = 29.807 + 0.235X1$. The further analysis is a statistic test. It is intended to verify it line regression equation coefficient that there on organizational factor variable (X1) can be accepted as a predictor to identify this phenomena that take place, like shipping safety (Y) is contributed by organizational factor (X1).

Based on its calculation can be known value of t_{calc} X1 variable is 3.65, and t_{table} (0.05;85) is 1.988 with significance value 0.000 (less than significance alpha 0.05). It is indicated that the direction of regression line can be used as a predictor to view correlation and contribution between organizational factor (X1) and shipping safety (Y).

A further analysis is a regression equation test that formed to test the level of it's significance. This analysis test is conducted with F test. The result is value F_{calc} is 99.176 and values of table (0.05; 1:85) is 3.9519 with significant value is 0.000 (less than significance alpha 0.05). It is indicated that regression equation models is formed $Y = 29.807 + 0.235X1$ is linear and significant at confidence level 95%.

Based on the analysis above can be concluded that shipping safety (Y) is contributed by organizational factor (X1). Therefore the first hypothesis that state shipping safety (Y) is contributed by organizational factor (X1) have been tested empirically and can be accepted at confidence level 95%. Contribution of organizational factor to shipping safety is 13.5%.

4.3.2 Second Hypothesis

Second hypothesis are shipping safety is contributed by group factor. A hypothesis that is proposed for this first hypothesis test are as below:

H0 = Shipping safety is not contributed by group factor

H1 = Shipping safety is contributed by group factor

By using a basis of decision making if value of Asymp. Significantly more than the value of significance level (0.05), H0 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H0 is rejected. The result of the second hypothesis test is the correlation coefficient between group factor and shipping safety (r_{x_2y}) is 0.243 and its determination coefficient is 0.059 with significant value is 0.002. (less than significance alpha 0.05). It is indicated that the correlation between group factor variable (X2) and shipping safety (Y) correlate at confidence level 95%.

Linear regression analysis with one variable independent is conducted to know the correlation between group factor variable (X2) and shipping safety (Y) predictive or not. Based on calculation then obtain regression line equation is $Y = 39.2726 + 0.284X_2$. The next analysis is a statistic test. It is intended to verify it line regression equation coefficient that there on group factor variable (X2) can be accepted as a predictor to identify this phenomena that take place, like shipping safety (Y) is contributed by group factor (X2).

Based on its calculation can be known value of t_{calc} X2 variable is 2.4, and $t_{table}(0.05;85)$ is 1.988 with significance value 0.002 (less than significance alpha 0.05). It is indicated that the direction of regression line can be used as a predictor to view correlation and contribution between group factor (X2) and shipping safety (Y).

A further analysis is a regression equation test that formed to test the level of it's significance. This analysis test is conducted with F test. The result are value F_{calc} is 14.626 and value of $F_{table}(0.05; 1:85)$ is 3.9519 with significant value is 0.002 (less than significance alpha 0.05). it is indicated that regression equation models is formed $Y = 39.2726 + 0.284X_2$ is linear and significant at confidence level 95%.

Based on the analysis above can be concluded that shipping safety (Y) is contributed by group factor (X2). Therefore second hypothesis that states shipping safety (Y) is contributed by group factor (X2) have been tested empirically and can be accepted at confidence level 95%. Contribution of group factor to shipping safety is 5.9%.

4.3.2 Third Hypothesis

Third hypothesis is shipping safety is contributed by individual factors. The hypothesis that be proposed for this first hypothesis test are as bellow:

H0 = Shipping safety is not contributed by individual factors

H1 = Shipping safety is contributed by individual factors

By using a basis of decision making if value of Asymp. Significantly more than the value of significance level (0.05), H0 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H0 is rejected. The result of the first hypothesis test is the correlation coefficient between individual factor and shipping safety (r_{X_3y}) is 0.243 and its determination coefficient is 0.059 with significant value is 0.002. (less than significance alpha 0.05). it is indicated that the correlation between individual factor variable (X3) and shipping safety (Y) correlate at confidence level 95%.

Linear regression analysis with one variable independent is conducted to know the correlation between individual factor variable (X3) and shipping safety (Y) predictive or not. Based on calculation then obtain regression line equation is $Y = 38.214 + 0.196X_3$. The next analysis is a t statistic test. It is intended to verify it line regression equation coefficient that there are on individual factor variable (X3) can be accepted as a predictor to

identify this phenomena that take place, like shipping safety (Y) is contributed by individual factor (X3).

Based on its calculation can be known value of t_{calc} X3 variable is 2.14, and $t_{table}(0.05;85)$ is 1.988 with significance value 0.019 (less than significance alpha 0.05). It is indicated that the direction of regression line can be used as a predictor to view correlation and contribution between individual factor (X3) and shipping safety (Y).

A further analysis is a regression equation test that formed to test the level of it's significance. These analytical tests are conducted with F test. The result are value F_{calc} is 26.51 and value of $F_{table}(0.05; 1:85)$ is 3.9519 with significant value is 0.0019 (less than significance alpha 0.05). It is indicated that regression equation models is formed $Y = 38.214 + 0.196X_3$ is linear and significant at confidence level 95%.

Based on the analysis above can be concluded that shipping safety (Y) is contributed by individual factor (X3). Therefore the third hypothesis that states shipping safety (Y) is contributed by an individual factor (X3) have been tested empirically and can be accepted at confidence level 95%. The contribution of individual factor to shipping safety is 17.4%.

4.3.4 Fourth Hypothesis

Fourth hypothesis are shipping safety is contributed together by organizational factor, group factor, and individual factor. The hypothesis that be proposed for this first hypothesis test are as bellow:

H0 = Shipping safety is not contributed together by human factors

H1 = Shipping safety is contributed together by human factors

By using a basis of decision making if value of Asymp. Significantly more than the value of significance level (0.05), H0 is accepted and if value of Asymp. Significance less than the value of significance level (0.05), H0 is rejected. The result of the fourth hypothesis test is the correlation coefficient between individual factor and shipping safety ($r_{X_1X_2X_3y}$) is 0.448 and its determination coefficient is 0.0288 with significant value is 0.000. (less than significance alpha 0.05). It is indicated that the correlation between three independent variables (X1, X2, X3) and shipping safety (Y) correlate at confidence level 95% and the value of Durbin Watson more than 2.79, its mean there is autocorrelation.

Multiple linear regression analysis with three variable independent is conducted to know the correlation between organizational factor (X1), group factor (X2), individual factor variable (X3) and shipping safety (Y) are predictive or not.

Based on calculation then obtain regression line equation is $Y = 34.459 + 0.263X_1 + 0.396X_2 + 0.583X_3$. The next analysis is a t statistic test. It is intended to verify it line regression equation coefficient that there on organizational factor variable (X1), group factor variable (X2), and individual factor variable (X3) can be accepted as a predictor to identify this phenomena that take place, like Shipping safety (Y) is contributed together by an organizational factor (X1), group factor (X2), and individual factor (X3).

Based on its calculation can be known value of t_{calc} for X1 variable is 4.168, t_{calc} X2 for variable is 3.322, t_{calc} for X3 variable is 5.584 and $t_{table}(0.05;85)$ is 1.988 with three significance valuations (X1, X2, and X3) are 0.000, 0.002, and 0.019 (less than significance alpha 0.05). It is indicated that the direction of regression line can be used as a predictor to view correlation and contribution together between organizational factor (X1), group factor (X2), individual factor (X3), and shipping safety (Y).

A further analysis is a regression equation test that formed to test the level of it's significance. These analytical tests are conducted with F test. The result is value F_{calc} is 38.419 and

value of table(0.05; 3:81) is 2.7173 with significant value is 0.000 (less than significance alpha 0.05). It is indicated that regression equation models is formed $Y = 34.459 + 0.263X_1 + 0.396X_2 + 0.583X_3$ is linear and significant at confidence level 95%.

Based on the analysis above can be concluded that shipping safety (Y) is contributed together by an organizational factor (X1), group factor (X2), and individual factor (X3). Therefore the fourth hypothesis that state shipping safety (Y) is contributed together by an organizational factor (X1), group factor (X2), and individual factor (X3) has been tested empirically and can be accepted at confidence level 95%. Contribution between three independent variables (human factors) to shipping safety is 28.8%.

5.0 DISCUSSION

According to Indonesia Marine Safety Coordination Agency (2009), shipping safety is a condition that complies with several requirements regarding safety and security of transportation in water, port, and maritime environment. Shipping safety basically is all activities that exist and can be developed in relation to accident prevention activities in the shipping area. In Indonesia several requirements regarding to safety and security of transportation in water, port, and maritime environment regulated in Indonesia Law No.17 of 2008.

One important factor in achieving the safety and sustainability of the marine environment is the human factors. Its human factors related to managing, supervising, competence level, stress, and motivation of people. But in reality the human factor is the biggest factor that contributes shipping accident like collision or contact (can be ship to ship or ship to other structures), capsizing, sinking, breaking up, breakdown of the ship underway, stranding, and fire or explosion. As has been mentioned by Marine Safety Authority of New Zealand (1996) 49% of shipping incidents cited human factors as a cause, while only 35% cite technical factors and 16% environmental while in Indonesia 39.3% shipping accident is caused by human factors and 60.7% shipping accident is caused by technical factor.²⁴

Based on result of the above, the validity of the hypothesis test show that all of the hypothesis H1 in this study can be accepted, either independently test of each other nor taken together. Its mean from simple regression analysis and multiple regression analysis, prove that there are contribution of organizational factor, group factor, and individual factor either the test is independent of each other nor taken together for shipping safety.

Analysis result from the first hypothesis proves that shipping safety is contributed by organizational factors. The obtained finding from data analysis is show that the correlation between organizational factor and shipping safety is 0.365 and the closeness of relationship between its two variables is 0.135. It means that the 13.5 % organizational factor is contribute shipping safety. Then analysis result from second hypothesis also proves shipping safety is contributed by group factor. The obtained finding from data analysis is show that the correlation between group factor and shipping safety is 0.243 and the closeness of relationship between its two variables is 0.059. It means that just 5.9% group factor is contribute shipping safety. And then the third hypothesis test proves that shipping safety is also contributed by individual factors. The obtained finding from data analysis is show that the correlation between individual factor and shipping safety is 0.418 and the closeness of relationship between its two variables is 0.174. It means that the 17.4 % individual factor is contribute shipping safety. When the hypothesis test is carried out together between three independent variables to dependent

variable show that correlation between three independent variables and shipping safety is 0.488 with closeness of relationship is 0.288. Its means 28% shipping safety are contributed by human factors. While 71.2% are thought to have originated from other factors that not studied in this study.

As an element of shipping safety, human factors have an important role in an effort to provide a cleaner and safer in its operation. But accidents frequently happen due to human factors. The high number of shipping accidents due to human factors is caused by a lower contribution of human factors to shipping safety. As mention in above only 28.8% shipping safety is contributed by human factors.

In shipping accident that caused by human factors, human behavior and performance and also safety culture can be the prevailing factors that prescribe the level of safety for numerous maritime transport procedures and practices of management.¹¹ This means that they can also influence, in a considerable degree, the protection of the marine and coastal environment. Thus, a flexible way to reduce the frequency and severity of naval accidents is, by identifying the contributing factors to the so-called human error, and by investigating for methods, which will either eliminate or mitigate these mistakes.

Other causes of lower contribution of human factors to shipping safety maybe also comes from Lack of concern for shipping safety of all parties include shipping company, ship's owner, government, regulatory authorities, classification society and other parties also be causes of lower contribution of human factors to shipping safety. However the solidness construction of the ship and no matter how sophisticated the technology and good navigational equipment, without good human factor according to their function then it will be vain.

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Based on the results of the study presently undertaken, the following conclusions can be made:

- i. There are 22 cases of shipping accidents during the last two years in the case study area. 14 cases of ship sinking, 4 cases of ship grounding, 2 cases of ship explosion or fire, 1 case of ship capsizing, and 1 case of ship collision. So during the last two years shipping accident that frequently happens is sinking.
- ii. There are three categories of human factors. They are individual factor which includes competence level, stress, and motivation. Group Factor which includes supervision, and crew factors. And organizational factor which includes company policies, company standards, systems and procedures.¹⁴
- iii. The correlation between organizational factor and shipping safety is 0.365 and contributions of organizational factor to shipping safety is 13.5% While the correlation between group factor and shipping safety is 0.243 and contributions of group factor to shipping safety is 5.9%. Then the correlation between individual factor and shipping safety is 0.418 and contributions of individual factor to shipping safety is 17.4%. And the last one correlation between three independent variables and shipping safety is 0.488 with contribution of three independent variables to shipping safety is 28%.

6.2 Recommendation

The present work has successfully shown the contribution of human factors to shipping safety. However, there are some

shortcomings in this study. Therefore some suggestions for further research and improvement are shown here:

- i. All parties which involve in shipping like to include shipping company, ship's owner, government; regulatory authorities, classification society and other parties should take a serious concern about safety in shipping.
- ii. This study only focuses on the contribution of human factors to shipping safety without a look at their safety culture, human behavior, and their adopted regulation on safety operation, safety management, crew requirements, etc.
- iii. Correlation and regression method is used to determine the contribution of human factors to shipping safety on this study by using software SPSS without doing a comparison with other software.
- iv. Qualitative method approaches have limitations, especially in the preparation of the questionnaire. Considering to questionnaire statements have been prepared based on the theory which its study is limited so there are some other aspects that have not been represented and not measurable.

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